Without any doubt, fog and rain are the two greatest enemies of the aviator. The worse of these is the fog, however. Rain to a pilot feels exactly as one's foot feels when "gone to sleep" except that it is about 10 times as bad. It feels as though someone had a mass of needles pressing them onto the hands and face, to say nothing of the extreme coldness of the result. Fog, or cloud, however, is very different. The order was given for a squadron of seaplanes to leave Hampton Roads, Va., to come north to greet the *George Washington* when she came back with President Wilson from France. On leaving Cape May, N. J., there was a cloud extending down to about 250 or 300 feet altitude, so the order was given to ascend above the clouds where flying was very simple by compass. Being seaplanes, there was a great fear that something would go wrong and that the squadron would be over land rather than water if forced to land suddenly, which would necessarily cause a total wreck. The commanding officer of the flagplane sent us all a radio message, "Remain aloft, am going down to ascertain weather conditions." We all received the message and ok'd it, then waited for the result. The flagplane dove into the clouds—out of sight—and in about 15 minutes another message came, "All clear 200 feet, descend." Immediately all the remaining planes dove into the clouds. We did not see the other planes until we had arrived at Rockaway Beach hours later. We were at that time in the vicinity of Atlantic City. We managed to fly along the surface of the water, barely able to see 100 yards ahead, contrary to the commanding officer's report, and having the constant fear of an approaching ship whose mast we might hit. We finally spied Fire Island Light, stopped, asked directions, and took off again. Soon the fog came in still worse, and many a time the wings would be at an angle of 45 to 60 degrees to the horizontal, which is great for a large, 5-ton seaplane. Both port and starboard pilots together worked as fast as they could, to keep her righted, the level-bulb being of no use because it did not show a horizontal owing to the turning of the seaplane. The climax came near Long Beach, where, coming out of the fog over water, we barely missed a house, rose, and turned, only to skim the top of a huge elm tree. Directly ahead was a little creek, into which our pilot headed the machine. It was just big enough to clear the banks. We put out our anchor immediately and waited for the fog to clear. At 11 o'clock it had lifted, but it was raining instead. As rain was merely disagreeable and fairly bad for the propellers, we made our way in the rain to Rockaway Beach. After landing, anchoring, covering up the motors, etc., our commanding officer came down and gave us the order to go out and meet the *George Washington*. All wet and cold, we "took-off" again and met the ship, the rain driving in our faces all the while.

These are but a few incidents which could be paralleled by many an aviator, especially by one who has flown in the South or over land and water.

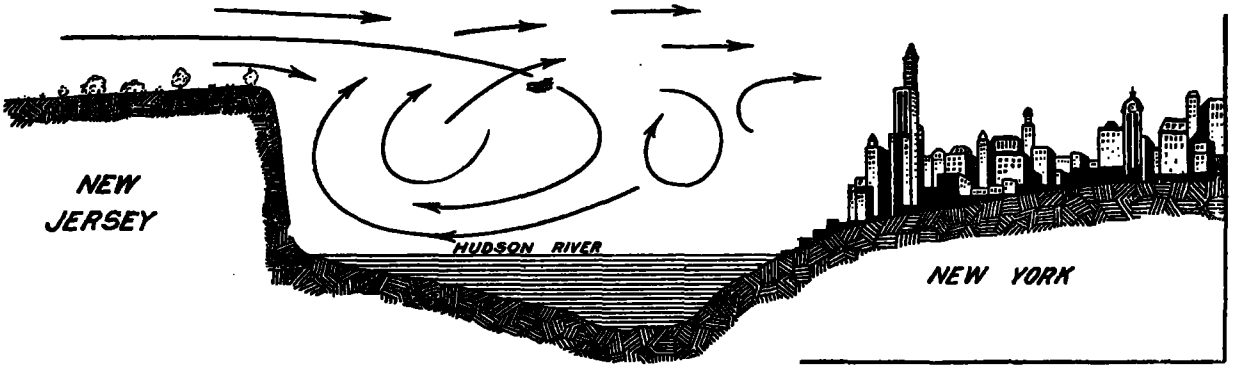

FIG. 1.—Showing the formation of a horizontal eddy over the Hudson River near New York City.

THE AUSTIN TORNADO OF MAY 4, 1922.

By FRED MORRIS, Cooperative Observer.

[University of Texas, Austin, Tex., June 14, 1922.]

EASTERN CLOUD.

The morning of May 4 was sultry, with clear skies and a very light southeast breeze. By 11 o'clock small cumulus clouds had begun to form. These clouds remained stationary, or practically so; if they had any movement it was so slight that their direction could not be noted.

By noon the cumulus clouds to the northeast had begun to develop into a cumulo-nimbus. There was nothing unusual in the appearance of the cloud at this time. It was just a "thunderhead" from which a shower might be expected later in the afternoon. It remained practically stationary, slowly increasing in size until about 2:30 p. m., when it began to spread southward.

At about 3:15 p. m., what appeared to be cumulus clouds at a very high altitude and moving rapidly were observed coming in from the southwest. Below these and coming in from a point somewhat east of south could be seen ragged patches of dark cloud. The scud floating rather low and at a high velocity was coming in from all directions south of a line drawn east and west through the university. These clouds formed rapidly into a huge ugly looking mass with a very low, densely black base and high pink summit. This new cloud was building up at a point somewhat east of the original cloud and about half way between it and town. The development of this second cloud was very rapid; also, it seemed to be moving southward as it developed. At about 3:45 p. m. the first sharp peal of thunder was heard. Up to this time the sky below the bases of these clouds had remained practically clear, but now began to show dark streaks, indicating that precipitation had begun.

By 3:50 p. m. a definite movement southward of both clouds was in progress. The eastern portion of the original cloud had become obscured by the second cloud

and lightning was more frequent. It had grown dark enough to make artificial lighting necessary in the buildings.

As the second cloud moved southward there was a visible lowering of the central portion of its base. There was a violent churning action about this protuberance, and the whole base of the cloud seemed badly agitated. No true tornado funnel had as yet developed in connection with this cloud, but the projection was lowering and the agitation becoming more violent as it moved southward.

From this time forward, developments were rapid. The whole storm was moving in a direction about 30° west of south and at an increasing rate of speed.

The destructive winds from this cloud were first felt at the State Cemetery, at Ninth and Comal Streets, where some branches were torn from trees. At this time it had the appearance of being only a fierce whirlwind. It next struck at Sixth and Navasota Streets, where two buildings were badly damaged. This was the first real property damage done by the wind from this cloud. Continuing southward and doing minor property damage on its way, it crossed First Street at Waller. Here one of the tall light towers was blown down across the Tenth Ward Fire Station.

From this point to the river a number of buildings in the path of the wind were badly damaged. Upon reaching the swollen river the true character of the cloud was outlined for the first time. An enormous volume of spray was lifted and whirled high into the air. It seemed as though a long white column of smoke had suddenly flashed into existence, and a few moments later as suddenly disappeared.

After crossing the river the whirl moved up the high south bank into Travis Heights, where a number of fine homes were damaged or destroyed. (See Fig. 3.)

From this point on the funnel-shaped cloud could be clearly seen. Viewed from the high downtown buildings it had the appearance of being a whirling, churning mass of clouds. Observers could clearly see the materials of the buildings thrown high into the air as building after building was struck. At this point the path was about 50 yards wide.

Continuing in a southerly direction, the wind next struck at St. Edward's College, where the dormitory, gymnasium, and power plant were destroyed. (See Figs. 5, 6, 7.)

Men working at Penn Field who were watching the approach of the storm said, "It looked like a funnel-shaped mass of cloud and dust, churning and whirling and carrying things high into the air and then scattering them in all directions." At the center of this whirling mass was a small black core about as big around as a man's body (viewed from Penn Field about one-half mile distant), moving along in a zig-zag path, swinging very much like the trunk of an elephant. As this black core moved forward everything seemed to rush in to meet it. Large trees were torn up by their roots and drawn in, tops first; buildings of all sizes just seemed to go to pieces, and the materials, especially the roofs, sail in toward this central core, where they were torn to pieces and carried high into the air. Some of this material was thrown out at a height of 100 feet or more, while some of it disappeared entirely.

The storm next struck Penn Field—the Woodward Manufacturing Co.'s plant—where the greatest property damage in the storm's path occurred. (Fig. 4.)

Immediately after striking Penn Field the cloud turned sharply to the southwest and passed through the St. Elmo neighborhood, where the Heartkoff Dairy plant, the Harper home, and the Holden residence were struck in succession and completely swept away. Other buildings in the neighborhood were damaged. (Fig. 2.) The width of the storm's path had gradually increased up to this point, and was about 225 yards wide here. Trees blown down along the western edge of the path were lying to the south, while those on the east side were lying to the north, showing the wind to have had a counter-clockwise direction, considering the clock lying face up on the ground.

Continuing in a southwesterly direction, the tornado struck and destroyed a number of farm properties in its

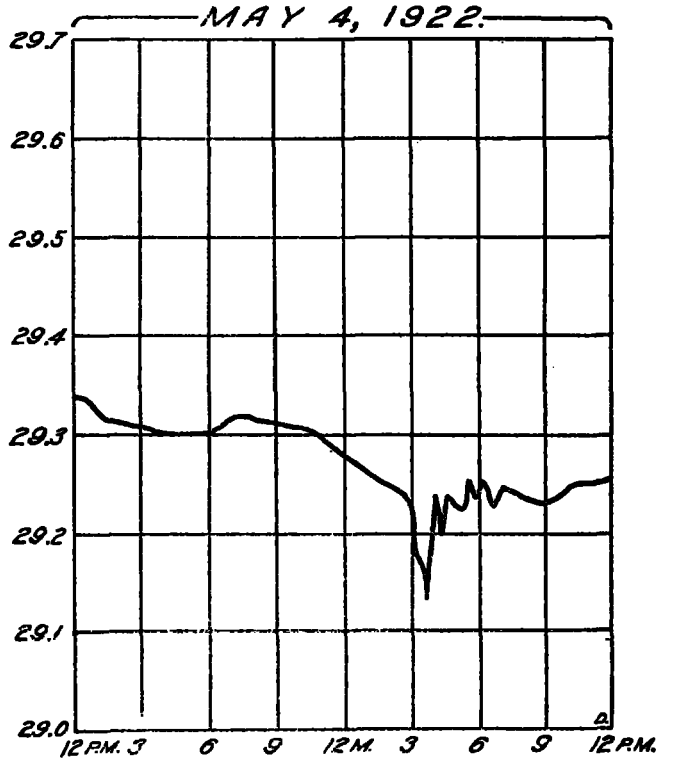

FIG. 12.—Trace of the barograph at the University of Texas on May 4, 1922, showing the disturbance at the time of the occurrence of tornadoes in that vicinity.

path. The next important destruction was in the neighborhood of Davis Hill, about half way between Manchaca and Oak Hill. The tornado seems to have been approaching Davis Hill along a straight line. At the foot of this hill some small houses were destroyed. The funnel then turned abruptly to the west and completely swept away the Bargsley home, killing six persons. A student at St. Edward's college was also killed, and other fatalities increase the total number of deaths to 12. Fifty persons were injured.

From this point on slight damage was done to farm property, as the funnel continued in a westerly direction and finally lifted from the ground. It is interesting to note that when last seen this funnel was lying in an almost horizontal position, and resembled very closely the funnel which swept through the western part of town.[1]

The trace of the University of Texas barograph is shown in Figure 12.

[1] Cf. MO. WEATHER REV., 45: 238; 47: 448-449.

FIG. 1.—The Austin tornado of May 4, 1922 (western cloud). This photograph was taken at 3:48 p. m., from the Littlefield Building, when the cloud was about 3 miles northwest of the camera. The funnel had just risen from the Negro Blind Institute when Mr. T. B. Kellum took the picture. Negative owned by the Gazley Co., 204 W. Sixth Street, Austin, Tex. (Courtesy Austin Chamber of Commerce.)

(To face p. 252.)

FIG. 2.—Site of the Harper home at St. Elmo. The house, which was destroyed by the eastern cloud formerly stood within the rectangle formed by the four oaks.

FIG. 3.—Home in Travis Heights damaged by the eastern cloud.

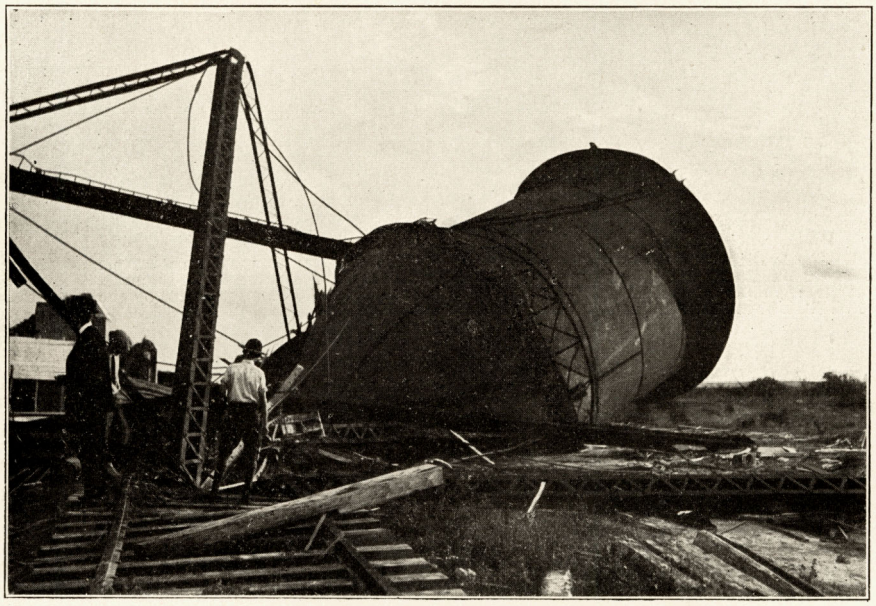

FIG. 4.—Water tower at Penn Field destroyed by the eastern cloud.

(To face p. 252.)

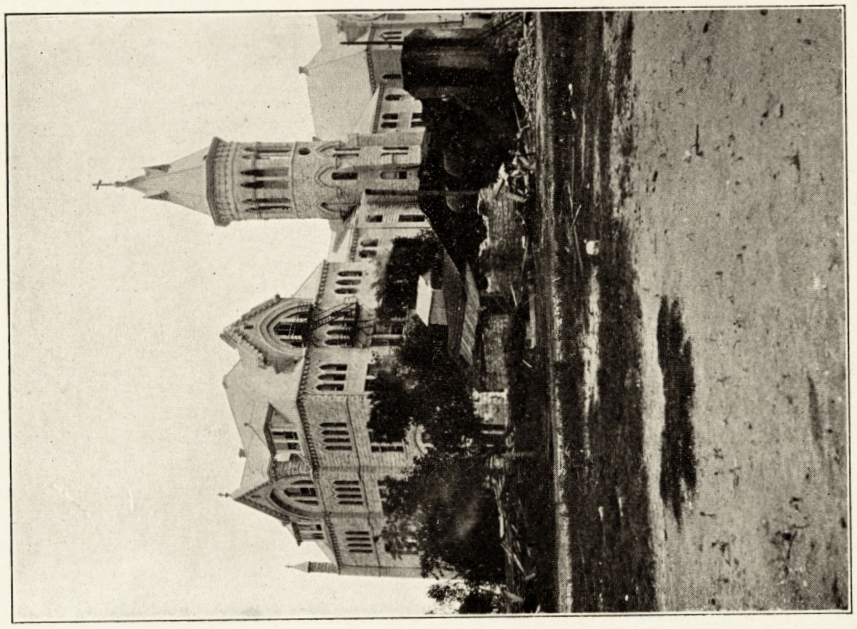

FIG. 7.—The power plant, St. Edwards College.

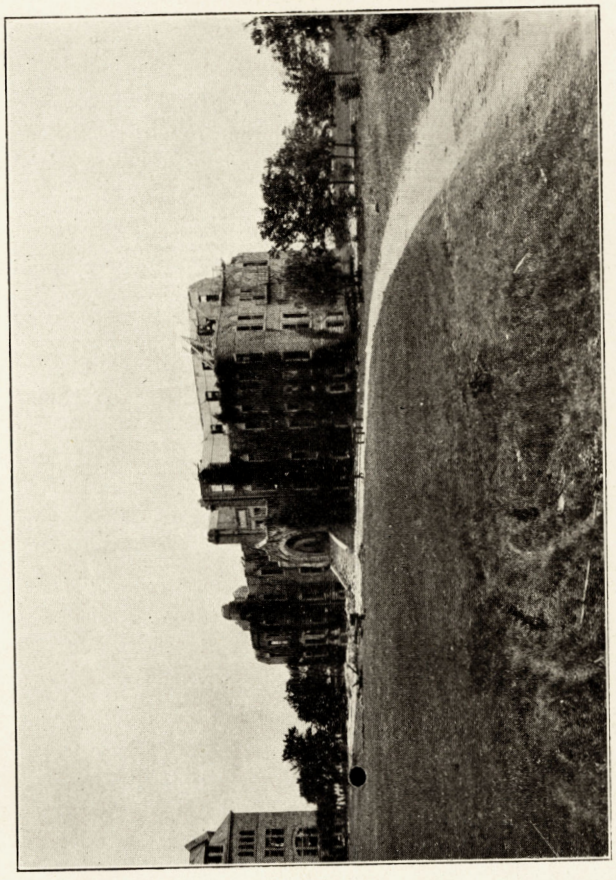

FIG. 5.—Front view of Holy Cross Hall, St. Edwards College, damaged by the eastern cloud.

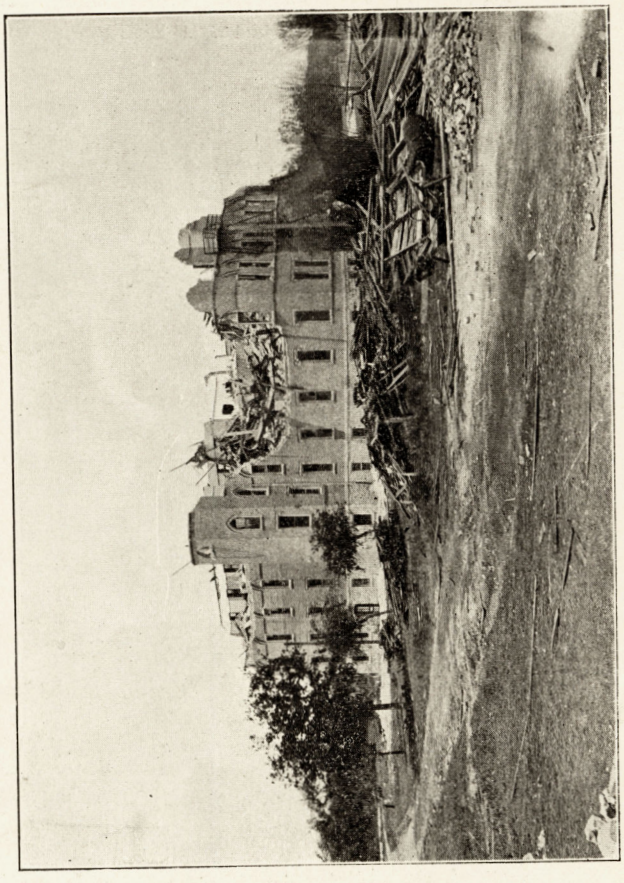

FIG. 6.—Rear view of Holy Cross Hall, St. Edwards College.

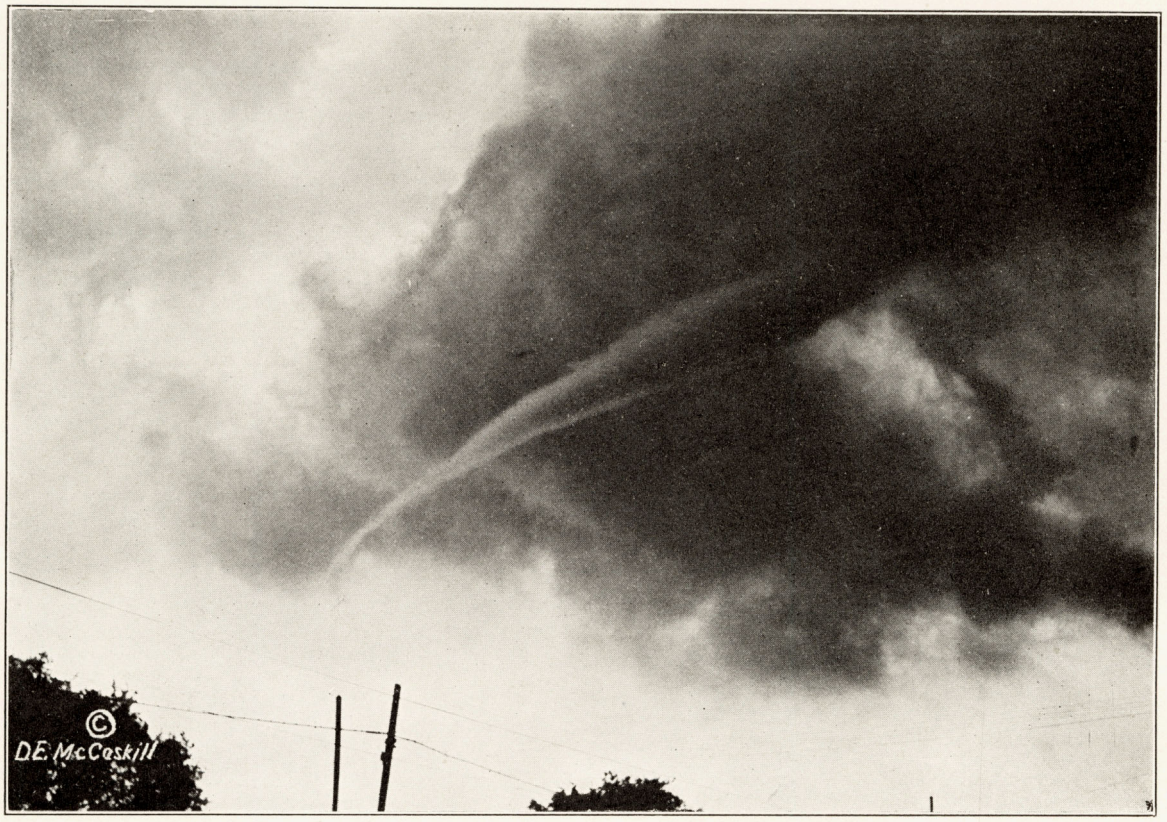

FIG. 8.—Western cloud of the Austin tornado. (Copyright, Photographic Laboratory, University of Texas.)

FIG. 9.—Western cloud of the Austin tornado. (Copyright, Photographic Laboratory, University of Texas.)

(To face p. 252.)

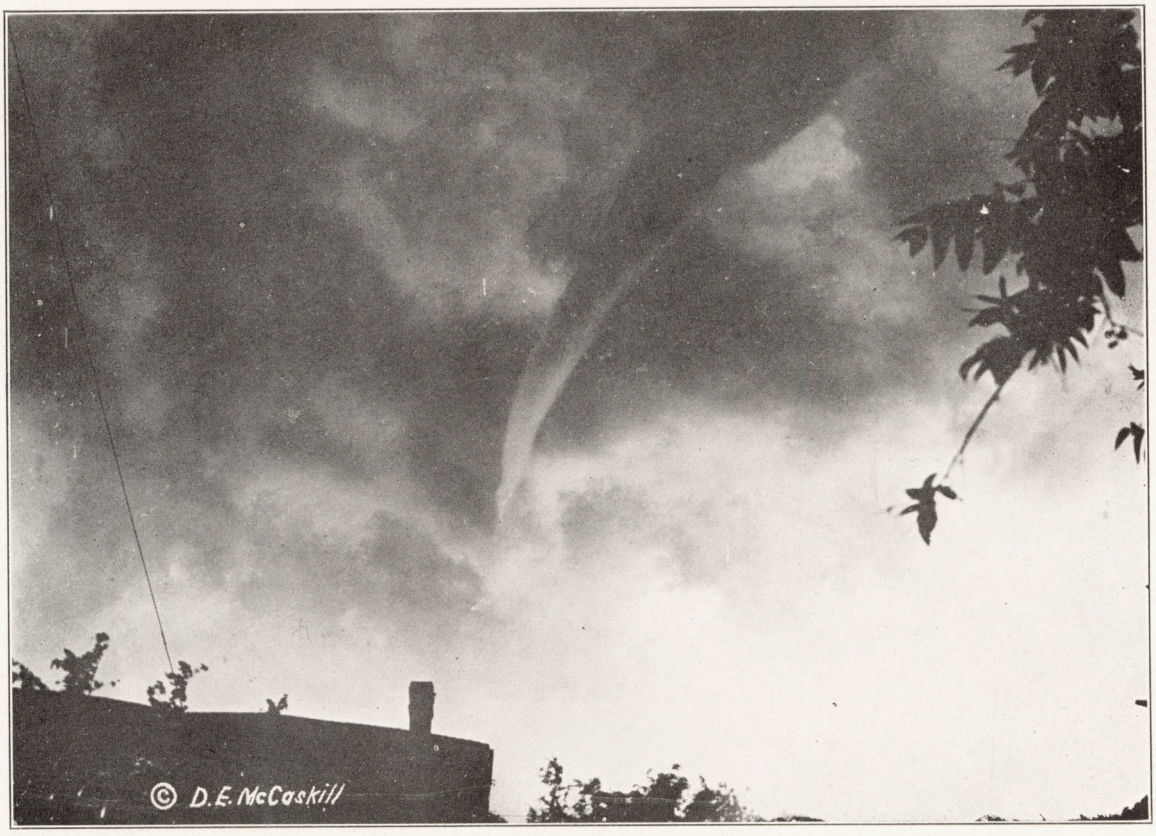

FIG. 10.—Western cloud of the Austin tornado. (Copyright, Photographic Labaratory, University of Texas.)

FIG. 11.—Austin tornado (western cloud). This photograph was taken by Mr. A. D. Boone, at 4:12 p. m., May 4, 1922, when the cloud was about 2 miles west of the camera. (Courtesy Austin Chamber of Commerce.)

WESTERN CLOUD.

While the eastern tornado was by far the larger and more destructive, it was not seen by nearly so many people as was the western cloud. (Figs. 1, 8, 9–11.) It was this spectacular western funnel which practically every one was watching while the eastern funnel formed and cut its destructive path through the southwestern portion of the county.

The wind from this cloud was first felt in contact with the ground at a point about 6 miles northwest of town, where some farm buildings were damaged. Its next important destruction was about 3 miles farther south, at the State school for the negro deaf, dumb, and blind. At this institution the industrial building, the laundry building, and a dormitory were destroyed. Moving in a southwestern direction and along a line practically parallel to the path of the eastern cloud, it next struck at Deep Eddy on the river's bank. At this point considerable property damage was done and two persons injured. Lifting a large volume of spray high into the air as it went, the whirl crossed the river, cut a path about 25 yards wide through the timbered hills, and eventually disappeared to the southwest. The path of this funnel while in contact with the ground was about 3 miles to the west of, and practically parallel to, the eastern funnel.

SOME OBSERVATIONS MADE ON THE ORIGIN, GROWTH, AND DISAPPEARANCE OF THE TORNADO WHICH PASSED WEST OF AUSTIN MAY 4, 1922.

By PAUL T. SEASHORE.

[University of Texas, June 14, 1922.]

While seated by a north window in Breckenridge Hall at the University of Texas on the afternoon of May 4 I became aware, due to the rumbling of thunder, of an accumulation of clouds in the north and northeast. On account of the heat of the early afternoon and of the knowledge that we were in an area of low pressure I thought it perhaps advisable to watch these clouds for symptoms of tornadic disturbances.

The clouds approached quite rapidly and seemed to be traveling in a southerly direction, perhaps slightly west of south. The approaching clouds were scarcely 5 miles away when I first became aware of the tornadic formative disturbance. In a position nearly due north a ragged edge, or that part which appears to an observer as being the bottom of the cloud had in one place dipped lower and had assumed the shape of a V with a slender threadlike appendage swinging from the bottom. This smokelike wisp was continually being drawn up into the larger V-shaped body, staying there for the space of a second or two, and then trailing down to the earth again, swinging to the right and to the left. This phenomenon was continued for possibly two or three minutes, and then the V-shaped body with its appendage disappeared.

After being absent for about the same length of time that it had been present, the body reappeared as before, only it had grown larger and had shifted from north to a position a few degrees west of north. Directly above this minature tornado small fragments of clouds were flying here and there with an irregular motion, confined, it seemed, however, to a certain area horizontally but not vertically. From this irregular boiling there gradually grew a regular movement, which was counterclockwise and assumed the shape of a narrow, slightly tapering cone inclined at an angle of about 30° with the horizontal. The small V-shaped body was drawn up into the larger cone, but the threadlike wisp of the former remained and was seen to grow larger, attach itself to the tip of the larger cone, and extend vertically to the ground. It remained on the ground for a few seconds and then drew up to a position about midway between the cone and the ground. The tornado at this stage was approximately north 25° west from my position. As the rapidly whirling gray cone passed to the west it assumed a more vertical position and appeared to grow slightly larger. Fragments of ragged clouds could be seen drawn into its vortex. After the cone had passed to the southwest of my point of observation it became funnel-shaped and again seemed to dip toward the earth. It now gradually broadened out, became bell-shaped and disappeared in a heavy rain.

This tornado was followed by a cloud having a bluish green color. The whirling cone itself had a grayish color until it became obliterated by the rain.

TORNADO FREQUENCY IN KANSAS.

By S. P. PETERSON, Meteorologist.

[Weather Bureau, Wichita, Kans., May 18, 1922.]

The following table has been compiled from the readily available records of tornadoes in Kansas so that there may be a clearer conception of the frequency of occurrence of tornadoes in that State. The records upon which the table is based are compiled from Mr. S. D. Flora's article on "Tornadoes in Kansas," published in the MONTHLY WEATHER REVIEW of December, 1915, and from the records of tornadoes found in the *Monthly Climatological Data* for Kansas for the years 1916 to 1921, inclusive, published by the Topeka Weather Bureau office, the *Climatological Data* having been carefully scanned for all records of tornadoes contained during that period. The total, apparently quite complete, records of tornadoes cover a period of 30 years—from 1874 to 1887, 1889 to 1896, and 1914 to 1921, inclusive. When tabulated we get the following results, showing the total number of tornadoes that have occurred in the various months during the period of record, from which is computed the average monthly frequency and the average number of tornadoes that may be expected to occur in Kansas per year.

TABLE 1.—*Tornado frequency in Kansas, 30 years' record (by months).*

	Total.	Average monthly frequency.
January	0	0.00
February	1	.03
March	19	.63
April	49	1.63
May	84	2.80
June	60	2.00
July	18	.60
August	16	.53
September	10	.33
October	5	.17
November	3	.10
December	0	.00
Total for 30 years	265	
Average per year	8.8	8.8